

# Penn Cambria Curriculum

<b>Course Name</b>	<b>Honors Chemistry II</b>
<b>Length of Course</b>	<i>1 credit (1 period per day for one semester)- Weighted at 1.10 for GPA calculations</i>
<b>Grade Level</b>	11-12 ** Dual Enrollment Course
<b>Prerequisites</b>	85% in Honors Chemistry 1 or 93% in Chemistry 1
<b>Course Description</b>	Honors Chemistry II is an extension of Honors Chemistry I. It provides a stronger background for college programs requiring a more extensive foundation in chemistry. The course emphasizes critical thinking and problem solving skills. Students will study solution chemistry, acid/base chemistry, chemical equilibrium, kinetics, redox, electrochemistry, and nuclear chemistry. Laboratory experience and proficiency is expected. This course may be taken for college credit through Mount Aloysius College.
<b>Units of Study</b>	Basic Chemistry Concepts Gases Bonding and Molecular Geometry Solutions Acids and Bases Oxidation and Reduction Processes Nuclear Chemistry
<b>Materials</b>	Text: Chemistry: The Central Science; Brown, LeMay, Bursten; © 2006 Supplemental Materials: lab materials and supplies

## Unit 1: Basic Chemistry Concepts

**Estimated Time:** 1.5-2.5 weeks

### Standard Alignment:

- 3.1.12.D – Analyze scale as a way of relating concepts and ideas to one another by some measure.
- 3.2.12.B – Evaluate experimental information for appropriateness and adherence to relevant science processes.
- 3.4.12.A – Apply concepts about the structure and properties of matter.

### Curricular Objectives:

#### Students will:

- a. Apply the rules of significant digits to scientific calculations.
- b. Utilize the periodic table to complete electron configurations and Lewis dot notations of atoms.
- c. Write chemical formulas for ionic compounds and binary covalent compounds.
- d. Name ionic compounds and binary covalent compounds given their chemical formulas.
- e. Convert between moles, particles and grams.
- f. Write both a word and balanced, formula equation for chemical reaction.
- g. Include state symbols in an equation which describe the reactants and products.
- h. Classify a chemical reaction as composition, decomposition, single replacement, double replacement or combustion.
- i. Predict the products of a chemical reaction, utilizing an activity series and solubility chart when appropriate.

- j. Interpret a balanced, chemical equation in terms of the mole relationships that exist between reactants and products.
- k. Solve stoichiometric problems.
- l. Determine the limiting reagent and excess reagent in a chemical reaction through stoichiometric calculations.
- m. Determine the percent yield of a chemical reaction through stoichiometric calculations.

**Assessments/ Measurement of Objectives:**

- Objective quizzes / test based on objectives
- Classroom activities/ projects/ calculations based on objectives

**Suggested Methods of Instruction / Learning Activities:**

- Electron configurations
- Bonding reactions
- Mole calculations
- Formula writing
- Use of appropriate nomenclature
- Reactions and equations
- Stoichiometry of a chemical reaction

<b>Unit 2: Gases</b>
----------------------

**Estimated Time:** 2-3 weeks

**Standard Alignment:**

- 3.1.12.D – Analyze scale as a way of relating concepts and ideas to one another by some measure.
- 3.2.12.B – Evaluate experimental information for appropriateness and adherence to relevant science processes.
- 3.2.12.C – Apply the elements of scientific inquiry to solve multi-step problems.
- 3.4.12.A – Apply concepts about the structure and properties of matter.

**Curricular Objectives:**

**Students will:**

- a. Review gas laws (Boyle's, Charles', Gay-Lussac's and combined).
- b. Review standard conditions of pressure/ temperature and the conversion between common units of these quantizes.
- c. Apply the Ideal gas law to determine the amount (moles) of a gas present at given conditions.
- d. Apply Dalton's law to determine the partial pressure of a gas in a mixture of gases under certain conditions.
- e. Apply Graham's law to determine the relative rate of effusion of two gases under identical conditions.
- f. Define molar volume.
- g. Calculate the volume of a gas involved in a chemical reaction through stoichiometric calculations at both standard and non-standard conditions.

**Assessments/ Measurement of Objectives:**

- Objective quizzes / test based on objectives
- Classroom activities/ projects/ calculations based on objectives
- Lab predictions / observations / reports

**Suggested Methods of Instruction / Learning Activities:**

- Guided practice in and out of class
- Dalton's law calculations
- Graham's law calculations
- Ideal gas law calculations
- Stoichiometric calculations
- Laboratory experiments and reports on:
  - Graham's law
  - Molar volume
  - Formula of an unknown compound

<b>Unit 3: Bonding and Molecular Geometry</b>
---

**Estimated Time:** 2-3 weeks

**Standard Alignment:**

3.4.12.A – Apply concepts about the structure and properties of matter.

**Curricular Objectives:**

**Students will:**

- a. Distinguish among ionic, covalent and metallic bonding.
- b. Explain the VSEPR theory and utilize it to determine the valence shape and molecular shape of a covalent molecule.
- c. Describe the formation of hybrid orbital and determine the hybrid utilized in a covalent molecule.
- d. Represent a covalent molecule with a Lewis structure.
- e. Calculate formal charges of atoms within a covalent molecule.
- f. Determine the bond type using electro negativity values.
- g. Determine the polarity of a covalent molecule and the direction of electron density.
- h. Distinguish among dispersion interactions, dipole-dipole interactions and hydrogen bonds.

**Assessments/ Measurement of Objectives:**

- Objective quizzes / test based on objectives
- Classroom activities/ projects/ calculations based on objectives
- Lab predictions / observations / reports

**Suggested Methods of Instruction / Learning Activities:**

- Guided practice in and out of class
- Ionic and covalent bonding reactions
- Lewis structures, molecular shapes and hybridization
- Molecular polarity
- Formal charge
- Intermolecular forces
- Laboratory experiments and reports on:
  - Stoichiometry of a chemical reaction

<b>Unit 4: Solutions</b>
--------------------------

**Estimated Time:** 2-3 weeks

**Standard Alignment:**

- 3.2.12.B – Evaluate experimental information for appropriateness and adherence to relevant science processes.
- 3.2.12.C – Apply the elements of scientific inquiry to solve multi-step problems.

3.4.12.A – Apply concepts about the structure and properties of matter.

**Curricular Objectives:**

**Students will:**

- a. Describe solvation.
- b. Distinguish among unsaturated, saturated and supersaturated solutions.
- c. Define solubility.
- d. Describe the effect of temperature and pressure changes on the solubility of a solute in solution.
- e. Apply Henry's law to determine the solubility of a gas in solution.
- f. Predict the solubility of a solute in both polar and non-polar solvents.
- g. Distinguish between hydrates and anhydrous salts.
- h. Calculate solution concentration in units of molarities, mass percent, volume percent, and molarities.
- i. Define a Colligative property.
- j. Describe the effect on boiling point, freezing point and vapor pressure upon the addition of a non-volatile solute.
- k. Calculate freezing and boiling point changes to a solution upon the addition of a non-volatile solute.

**Assessments/ Measurement of Objectives:**

- Objective quizzes / test based on objectives
- Classroom activities/ projects/ calculations based on objectives
- Lab predictions / observations / reports

**Suggested Methods of Instruction / Learning Activities:**

- Guided practice in and out of class
- Henry's law calculations
- Solubility predictions
- Percent concentration calculations
- Molarity calculations
- Molality calculations
- Laboratory experiments and reports on:
  - Distillation
  - Water of Hydration

<b>Unit 5: Acids and Bases</b>
--------------------------------

**Estimated Time:** 3-4 weeks

**Standard Alignment:**

3.2.12.B – Evaluate experimental information for appropriateness and adherence to relevant science processes.

3.2.12.C – Apply the elements of scientific inquiry to solve multi-step problems.

3.4.12.A – Apply concepts about the structure and properties of matter.

**Curricular Objectives:****Students will:**

- a. Identify several physical properties of acids and bases.
- b. Name and write chemical formulas of binary acids and oxy-acids.
- c. Define an acid and base with respect to three theories: Arrhenius, Bronsted-Lowry and Lewis.
- d. Distinguish among monoprotic, diprotic, and triprotic-acids.
- e. Complete a proton-transfer reaction.
- f. Identify and name the conjugate acid-base pairs in a proton-transfer reaction.
- g. Recognize the pH scales as a logarithmic function used to describe the acidity of a solution.
- h. Calculate the pH, pOH,  $[H^+]$  and  $[OH^-]$  of a given solution and determine if the solution is acidic, basic or neutral.
- i. Distinguish between a weak and strong acid and a weak and strong base.
- j. Utilize acid/base dissociation constants ( $K_a/K_b$ ) to calculate the pH of weak acid/base solutions.
- k. Use indicators to test for the acidic/basic properties of a substance.

**Assessments/ Measurement of Objectives:**

- Objective quizzes / test based on objectives
- Classroom activities/ projects/ calculations based on objectives
- Lab predictions / observations / reports

**Suggested Methods of Instruction / Learning Activities:**

- Guided practice in and out of class
- Acid nomenclature/formula writing
- Proton-transfer reactions
- Conjugate acid/base pairs
- pH, pOH,  $[H^+]$  and  $[OH^-]$  calculations
- $K_a$  and  $K_b$  calculations
- Laboratory experiments and reports on:
  - Acid/base Testing with Indicators
- Writing prompts
  - Colligative properties (salting winter roads)

**Unit 6: Oxidation and Reduction Processes**

**Estimated Time:** 2-3 weeks

**Standard Alignment:**

- 3.2.12.B – Evaluate experimental information for appropriateness and adherence to relevant science processes.
- 3.2.12.C – Apply the elements of scientific inquiry to solve multi-step problems.
- 3.4.12.A – Apply concepts about the structure and properties of matter.

**Curricular Objectives:****Students will:**

- a. Compare and contrast oxidation and reduction.
- b. Identify oxidizing and reducing agents.
- c. Assign oxidation numbers.
- d. Describe the change in oxidation numbers of an element as both oxidation and reduction occurs.
- e. Balance redox equations in acidic and basic solution using the half-reaction method.

#### **Assessments/ Measurement of Objectives:**

- Objective quizzes / test based on objectives
- Classroom activities/ projects/ calculations based on objectives
- Lab predictions / observations / reports

#### **Suggested Methods of Instruction / Learning Activities:**

- Guided practice in and out of class
- Redox reaction/equations
- Assigning oxidation numbers
- Oxidizing/reducing agents
- Balancing redox equations
- Laboratory experiments and reports on:
  - Redox titration
- Outside Readings
  - Vitamin C

<b>Unit 7: Nuclear Chemistry</b>
----------------------------------

**Estimated Time:** 2-3 weeks

#### **Standard Alignment:**

3.4.12.A – Apply concepts about the structure and properties of matter.

3.8.12.B – Apply the use of ingenuity and technological resources to solve specific societal needs and improve the quality of life.

#### **Curricular Objectives:**

##### **Students will:**

- a. Characterize alpha, beta, and gamma radiation by composition and penetrating power.
- b. Write a balanced, nuclear decay equation.

- c. Solve half-life problems.
- d. Compare and contrast nuclear fission and nuclear fusion.
- e. Explain the impact of nuclear energy on society.
- f. Explain the use of radioisotopes in medicine.

**Assessments/ Measurement of Objectives:**

- Objective quizzes / test based on objectives
- Classroom activities/ projects/ calculations based on objectives
- Lab predictions / observations / reports

**Suggested Methods of Instruction / Learning Activities:**

- Guided practice in and out of class
- Nuclear decay equations
- Half-life problems
- Laboratory experiments and reports on:
  - Half-life
- Outside Reading
  - WWII and the Atomic Bomb
  - Three Mile Island